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(54) Title: INDUCTIVE SIGNAL TRANSFER SYSTEM FOR COMPUTING DEVICES

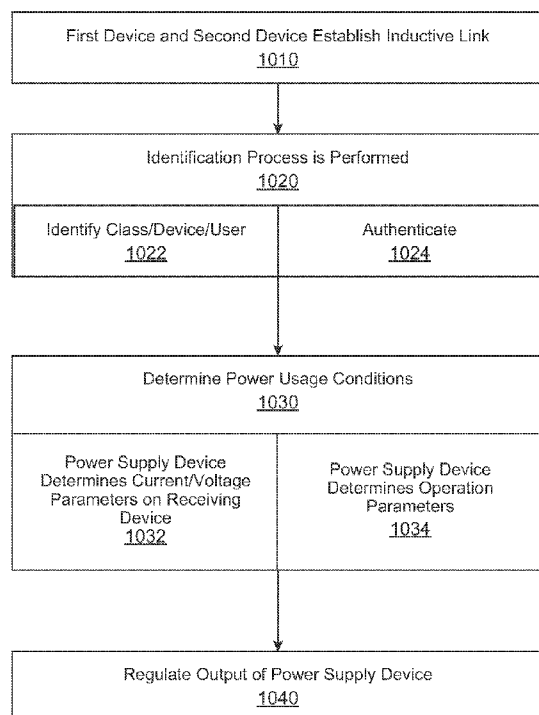


FIG. 10

(57) Abstract: At least two devices are provided that can each form part of a system to inductively exchange power and data. One device is capable of inductively transmitting a power signal to a second device, and to receive feedback from the second device in order to regulate the power signal.



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What is claimed is:

1. A computing system comprising:
a first computing device and a second computing device that are each configured to (i) inductively transmit or receive a power signal, and to (ii) inductively communicate data using a communication protocol; and
wherein each of the first and second computing devices is configured to inductively communicate data by signaling data packets that are structured in accordance with the communication protocol, which includes at least one of (i) an initial data packet that is transmitted repeatedly until an acknowledgement response data packet is received; or (ii) the acknowledgement response data packet that is transmitted in response to receiving the initial data packet;
wherein the first and second computing device are configured to inductively signal data in response to being brought into sufficient proximity to one another.
2. The computing system of claim 1, wherein data packets that are inductively communicated amongst the first and second computing devices include data packets for authenticating or enumerating at least one of the first or second computing devices.
3. The computing system of claims 1 or 2, wherein at least one of the first or second computing devices inductively transmits power to the other device and regulates the power signal in response to data indicative of a voltage or current state of the other device.
4. The computing system of claims 1 through 3, wherein each of the first and second computing devices includes one or more coils to signal power and data.

5. The computing system of claim 4, wherein the first and second computing devices are configured to automatically communicate with one another using a radio frequency communication medium upon the first and second computing devices being inductively coupled using the communication protocol.

6. The computing system of claim 5, wherein the communication protocol communicates data that is indicative of power requirements of at least one of the first or second computing devices, and wherein said data is used to modulate the signaled power to accommodate the power requirements indicated by the said.

7. The computing system of claim 6, wherein at least one of the first or second computing devices signals data under the communication protocol by pulse modulating the inductively transmitted power signal.

8. A computing system comprising:

a mobile computing device and an accessory device that are each configured to (i) inductively transmit or receive a power signal, and to (ii) inductively communicate data using a communication protocol; and

wherein each of the mobile computing device and the accessory device is configured to inductively communicate data by signaling data packets that are structured in accordance with the communication protocol, which includes at least one of (i) an initial data packet that is transmitted repeatedly until an acknowledgement response data packet is received; or (ii) the acknowledgement response data packet that is transmitted in response to receiving the initial data packet;

wherein the mobile computing device and the accessory device are configured to inductively signal data in response to being brought into sufficient proximity to one another.

9. The computing system of claim 8, wherein data packets that are inductively communicated amongst the mobile computing device and the accessory device include data packets for authenticating or enumerating the at least one of the mobile computing device or the accessory device.

10. The computing system of claims 8 or 9, wherein at least one of the mobile computing device or the accessory device inductively transmits power to the other device and regulates the power signal in response to data indicative of a voltage or current state.

11. The computing system of claim 10, wherein at least one of the mobile computing device or the accessory device signals the data in real-time in order to enable the other device to regulate the power signal.

12. The computing system of claims 8 or 11, wherein the communication protocol is a real-time protocol for regulating the transmitted power signal.

13. The computing system of claim 12, wherein the mobile computing device and the accessory device are configured to implement the real-time protocol by inductively transmitting a data signal at the same time as communicating the power signal.

14. The computing system of claim 10, further comprising:
processing resources, operative on at least one of the mobile computing device or the accessory device, in order to signal a feedback to

the other device that includes data to indicate one or more power conditions on the at least one of the mobile computing device or the accessory device.

15. The computing system of claim 14, further comprising:

processing resources, operative on at least one of the mobile computing device or the accessory device, in order to respond to the feedback by modulating an output level of the power signal in order to supply more or less power to the other device.

16. The computing system of claim 15, wherein the processing resources operative on at least the mobile computing device or the accessory device detect, from the feedback, whether power leakage is occurring in signaling the power.

17. An accessory device for a mobile computing device, the accessory device comprising:

one or more coils which are coupled to a power source in order to establish an inductive link with the mobile computing device; and
processing resources configured to:

control a power signal that is inductively transmitted using the one or more coils;

wherein the accessory device is configured to inductively signal data to the mobile computing device using a communication protocol in which the accessory device modulates an inductive data signal that communicates data packets which are structured in accordance with the communication protocol;

wherein data packets that are inductively communicated to the mobile computing device, in accordance with the communication protocol, include (i) an initial data packet that is repeatedly

transmitted from the accessory device until an acknowledgement data packet is inductively received from the mobile computing device.

18. The accessory device of claim 17, wherein the processing resources control the power signal by (i) identifying one or more current or voltage conditions on the mobile computing device, and (ii) varying a magnitude of the power signal based on presence of one or more conditions.

19. The accessory device of claims 17 or 18, further comprising:
an inductive receiver that is coupled to the processing resources and to one of the one or more coils;

wherein the receiver communicates data that is indicative of the one or more current or voltage conditions to the processing resources.

20. A computing device comprising:
one or more coils;
processing resources, operative with the one or more coils, to (i) detect a power signal that is inductively transmitted over the one or more coils from an accessory device, and to (ii) signal a feedback to the accessory device that includes data that is indicative of a voltage or current condition on the computing device;

wherein the computing device is configured to inductively signal data packets to the accessory device using a communication protocol;

wherein data packets that are inductively communicated amongst the computing device and the accessory device, in accordance with the communication protocol, include an acknowledgement response data packet that is transmitted from the computing device in response to the computing device being brought into sufficient proximity or contact with the accessory device to inductively receive the initial data packet.

21. The computing device of claim 20, further comprising a housing that contains a plurality of components of the computing device, and wherein the one or more coils are embedded within a housing segment that comprises a portion of the housing, apart from a remainder of the housing.

22. The computing device of claims 20 or 21, wherein the processing resources are configured to signal the feedback inductively using one of the coils.

23. The computing device of claims 20 through 22, wherein the processing resources, the one or more coils, and the section of the housing are modularized into one manufactured unit.

24. The computing device of claim 23, wherein data packets that are inductively communicated amongst the computing device and accessory device include data packets for authenticating or enumerating the computing device to the accessory device.

25. The computing device of claim 24, wherein the accessory device is configured to enable or disable one or more features in response to data packets for authenticating or enumerating the computing device.

26. An accessory device for a computing device, the accessory device comprising:

one or more coils;

processing resources, operative with the one or more coils, to (i) inductively signal over the one or more coils to the computing device, and(ii) respond to a feedback signal communicated from the computing device that

includes data to indicate how the accessory device is to modulate the power signal based on a power level or consumption on the computing device;

wherein the accessory device and the computing device are configured to inductively signal data to one another using a communication protocol;

wherein data packets that are inductively communicated amongst the computing device and the accessory device, in accordance with the communication protocol, include an initial data packet that is repeatedly transmitted from the accessory device until an acknowledgement data packet is received from the computing device.

27. The accessory device of claim 26, wherein the feedback signal is inductively received using the one or more coils.

28. The accessory device of claims 26 or 27, wherein the processing resources include one or more processors.

29. The accessory device of claims 26 through 28, further comprising a housing that includes a platform to support a back face of the mobile computing device.

30. The accessory device of claim 29, wherein the platform includes one or more magnets that are positioned to magnetically couple to correspondingly positioned magnetically attractive material on the back face of the mobile computing device.

31. The accessory device of claim 26, wherein data packets that are inductively communicated amongst the computing device and accessory device include data packets for authenticating or enumerating the computing

device to the accessory device.

32. The accessory device of claim 31, wherein the accessory device is configured to enable or disable one or more features in response to data packets for authenticating or enumerating the computing device.

33. A device comprising:

- one or more coils positioned on the device to establish an inductive link with a second device;

- one or more power components to receive power from a power source and to generate a power signal over the inductive link; and

- processing resources configured to:

- maintain the device in a low power state in which the one or more coils are substantially not powered;

- detect the second device positioned to be inductively linked with the device; and

- respond to detecting the second device by transmitting the power signal using the one or more coils;

- wherein each of the device and the second device are configured to inductively signal data to one another using a communication protocol in which one or both devices modulate an inductive data signal that communicates data packets which are structured in accordance with the communication protocol;

- wherein data packets that are inductively communicated amongst the device and second device, in accordance with the communication protocol, include (i) an initial data packet that is repeatedly transmitted from at least the device, and (ii) an acknowledgement response data packet that is transmitted from at least the second device in response to the second device being

brought into sufficient proximity or contact with the device to inductively receive the initial data packet, wherein the device repeatedly transmits the initial data packet until the acknowledgement data packet is received from the second device.

34. The device of claim 33, wherein in the low power state, the processing resources are configured to activate the one or more coils for short, intermittent durations in order to determine whether the second device is present.

35. The device of claims 33 or 34, wherein the processing resources are configured to activate the one or more coils in response to detecting the second device by identifying one or more of (i) an identity of the second device, (ii) a type of the second device, or (iii) one or more capabilities of the second device.

36. The device of claim 33, wherein data packets that are inductively communicated amongst the device and the second device include data packets for authenticating or enumerating the device to the second device.

37. A method for operating a device to inductively link with a second device, the method comprising:

- maintaining the device in a low power state in which the one or more coils are substantially not powered;

- repeatedly checking on the second device to be sufficiently proximate to the device to enable the two devices to be inductively linked;

- responding to detecting the second device by inductively signaling a power signal to the second device; and

inductively exchanging data with the second device in order to regulate the power signaled to the second device;

wherein inductively exchanging data includes using a communication protocol to exchange data.

STATEMENT UNDER PCT ARTICLE 19

Applicant respectfully requests entry of the accompanying Substitute Sheets 46-56 to replace original sheets 46-53, corresponding to original Claims 1-35 and the original abstract of the disclosure.